

Alternator and Regulator Troubleshooting

BALMAR®

Determining the causes of failures in an electrical system is a “step by step” process. We recommend that you inspect and clean all system electrical connections before you begin your search to determine if the failure can be attributed to one of the two main components of your charging system: the alternator, and/or the voltage regulator.

Most charging system problems will be corrected by performing the following steps.

1. Remove and clean all charging system electrical connections from the alternator through the batteries (this includes the ground side). Also, check the voltage regulator’s harness for resistance. Wires and terminals can and will become corroded and need to be cleaned or replaced.
2. Charge all batteries to their proper fully charged state and determine if they are serviceable. If your batteries are flooded-type, use your hydrometer to determine their condition.
3. Check and tighten alternator belt. If the belt shows signs of wear or damage, now is an ideal time for replacement. Always replace existing belts with the finest quality replacements available.

After determining that your batteries and wiring are in suitable condition, use the following tests to determine if charging problems are a result of a faulty alternator or regulator. The following tests provide an opportunity to isolate the alternator, regulator and wiring harness in order to determine which component may be malfunctioning. In order to perform these tests, you will need an independent multimeter (preferably a digital type). In an emergency, a 12V light bulb can be used to help determine if power or working grounds exist. An amp meter and a battery hydrometer with a thermometer are also helpful diagnostic tools.

Alternator /Regulator Field Tests

Test A - The alternator and regulator can be tested for function by determining if a magnetic field exists at the alternator’s pulley shaft or rear bearing. To test:

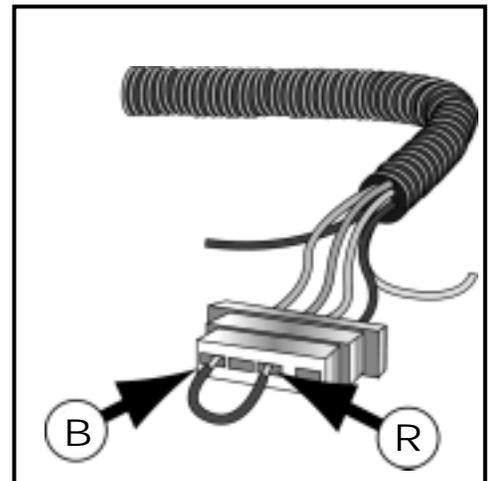
1. With the ignition in the OFF position, place the head of a steel screwdriver near the nut on the pulley shaft or near the rear bearing of the alternator. There should be no evidence of a magnetic field pulling the screwdriver toward the alternator.
2. Engage the ignition, without starting the engine, to activate the voltage regulator. If an oil pressure switch is used, a jumper across the switch will activate the regulator.
3. After allowing time for the regulator’s start-up delay, place the head of a steel screwdriver near the nut on the pulley shaft or near the rear bearing of the alternator. There should be evidence of a magnetic field pulling the screwdriver toward the alternator. If a magnetic field is present, the voltage regulator, alternator brushes and rotor are likely to be working properly. If the system is not charging, remove the alternator and have it inspected by a qualified alternator shop.

Test B - If there is little or no magnetic pull at the pulley shaft or at the rear bearing, initiate the following test:

1. With the key off and the engine off, remove the large harness plug from the regulator.
2. Insert the end of a short length of electrical wire to the RED connector slot of the regulator harness and the other end of the wire to the BLUE connector slot. (See **Figure 10**.) This bypasses the regulator and tests the alternator and the harness.
3. Using your steel screwdriver, inspect for a magnetic field as described above.
4. With your voltmeter, check for voltage on the blue wire at the alternator. If voltage does not exist, the harness may be at fault. If voltage does exist at the harness, but charging is not occurring, the alternator is likely to be malfunctioning.

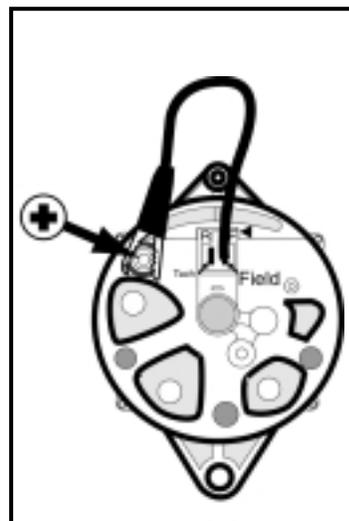
If a magnetic field is present. Both harness and alternator brushes and rotor appear to be working properly. If no magnetic field is present, proceed with the next test.

Test C - Testing the actual output of the alternator is known as “Full Field Testing”. This can be accomplished by jumping a positive 12VDC current to the field terminal at the rear of the alternator. This test eliminates both the regulator and the harness, making it easier to isolate your investigation to the alternator. **CAUTION: Ensure that all voltage sensitive equipment is turned off prior to starting the engine. Voltage is unregulated during this test and could damage sensitive electronics. DO NOT let the engine run any longer than necessary to detect charging.**



To test the alternator:

1. Clip a jumper wire to the positive post of the alternator, or on the battery side of the isolator, if an isolator is in use (see **Figure 11**). Use a SHIELDED alligator clip for post attachment. Unintentional contact between the alligator clip and the alternator case could result in damage to your electrical system.
2. Disconnect the field/stator plug from the rear of the alternator and attach the other end of the jumper wire to the alternator's Field terminal (F). Attach a female spade connector to the field end of the wire for a solid connection. **CAUTION:** Do not allow the wire to contact the case while it is attached to the positive post. The case is grounded and severe damage could occur.
3. The regulator is now bypassed. When the ignition is engaged and the motor is started, the voltage should rise and charging current should be present.
4. The motor should be run long enough to determine that charging voltage is present. Unregulated voltage can rise quickly. Do not allow extended unregulated charging to occur without carefully monitoring voltage levels.



If the alternator fails to generate voltage during field testing, a malfunction of the alternator is likely. Contact your local alternator repair shop or Balmar's technical service staff for recommendations.

Voltage Regulator Test

When you have inspected and repaired any wires and connections, inspected belts and replace as needed, and after you have determined that your batteries are properly charged, set your voltmeter to 12V and connect the voltmeter's negative lead to the BLACK ground wire at the regulator. Normally, connection is accomplished by inserting the negative lead alongside the ground wire in the regulator harness plug (see **Figure 12**) and the positive lead alongside the wire referred to in each specific test. With the voltmeter securely connected to the regulator's ground, test for voltage at the points listed below.

1. With the ignition in the OFF position and your voltmeter's ground wire connected to the regulator's ground, check for voltage on the RED (sensing), BLUE (field) and BROWN (ignition) wires in the regulator plug by inserting the positive lead of the voltmeter alongside each wire in the regulator harness plug. The voltmeter should read:

	Red Wire	Brown Wire	Blue Wire
Expected Reading	12 V *	0 V	0 V
Your Reading			

2. With the ignition in the ON position (engine not running) and your voltmeter's ground wire connected to the regulator's ground, check for voltage on the RED (sensing), BLUE (field) and BROWN (ignition) wires in the regulator plug. The voltmeter should read:

	Red Wire	Brown Wire	Blue Wire
Expected Reading	12 V*	12 V	7 - 12 V
Your Reading			

3. With the ignition in the ON position (with engine running at 1,400 rpm fast idle) and your voltmeter's ground wire connected to the regulator's BLACK wire, check for voltage on the RED (sensing), BLUE (field) and BROWN (ignition) wires in the regulator plug. The voltmeter should read:

	Red Wire	Brown Wire	Blue Wire
Expected Reading	12 - 14V**	12 V	4 - 12 V
Your Reading			

* 11.5 - 12.8 VDC battery voltage at rest (no charging occurring). If your batteries are isolated and your RED (sensing) wire shows voltages other than those shown above, make sure that the wire is connected on the "battery" side of the isolator. The RED wire must "see" the battery directly.

** 13.5 - 14.5 VDC battery voltage when charging.

If your readings differ substantially from the "Expected Readings" listed in the charts above, the regulator may be malfunctioning, or there may be a continuity problem. Contact our technical support staff at (360) 435-6100. Keep your recorded readings in the spaces provided below the "Expected Readings" so you can share them with the technical support person. If your readings match those listed in the charts, your regulator should be working correctly. Continue with tests below to determine if your alternator may be the source of charging difficulties. If the preceding tests do not prove the existence of a failure within the regulator or alternator, we recommend you contact a licensed marine electrician who can test your system for wiring and circuit damage or other system failures that could be responsible for charging difficulties. If you determine that repair service is necessary for either your alternator or regulator, please gather the following information before contacting our service technicians.

1. Model of alternator.
2. Model of voltage regulator.
3. Voltage readings on red, brown and blue wire at regulator with engine off, key on.
4. Voltage readings on red, brown and blue wire at regulator with engine running at a fast ideal 1400 rpm.